Electronic supplementary information

Design and synthesis of ice-templated PSA cryogels for water purification: Towards tailored morphology and properties

Siew-Leng Loo[a,b], William B. Krantz[a,c], Teik-Thye Lim[a,b], Anthony G. Fane[a,b,*], Xiao Hu[a,d**]

[a]Singapore Membrane Technology Centre, Nanyang Technological University, Singapore 639798, Singapore.

[b]School of Civil and Environmental Engineering, Nanyang Technological University, Block N1, 50 Nanyang Avenue, Singapore 639798, Singapore.

[c]Department of Chemical and Biological Engineering, University of Colorado, Boulder, Colorado 80309-0424, USA.

[d]School of Materials Science and Engineering, Nanyang Technological University, Singapore 639798, Singapore.

*****Corresponding author: Tel.: +61 2 9385 4315; fax: +61 2 9385 5966

[**]Corresponding author at: School of Materials Science and Engineering, Nanyang Technological University, Singapore 639798, Singapore. Tel: +65 67904610; Fax: +65 68909081

Email addresses: a.fane@unsw.edu.au *(A. G. Fane),* ASXHU@ntu.edu.sg *(X. Hu).*

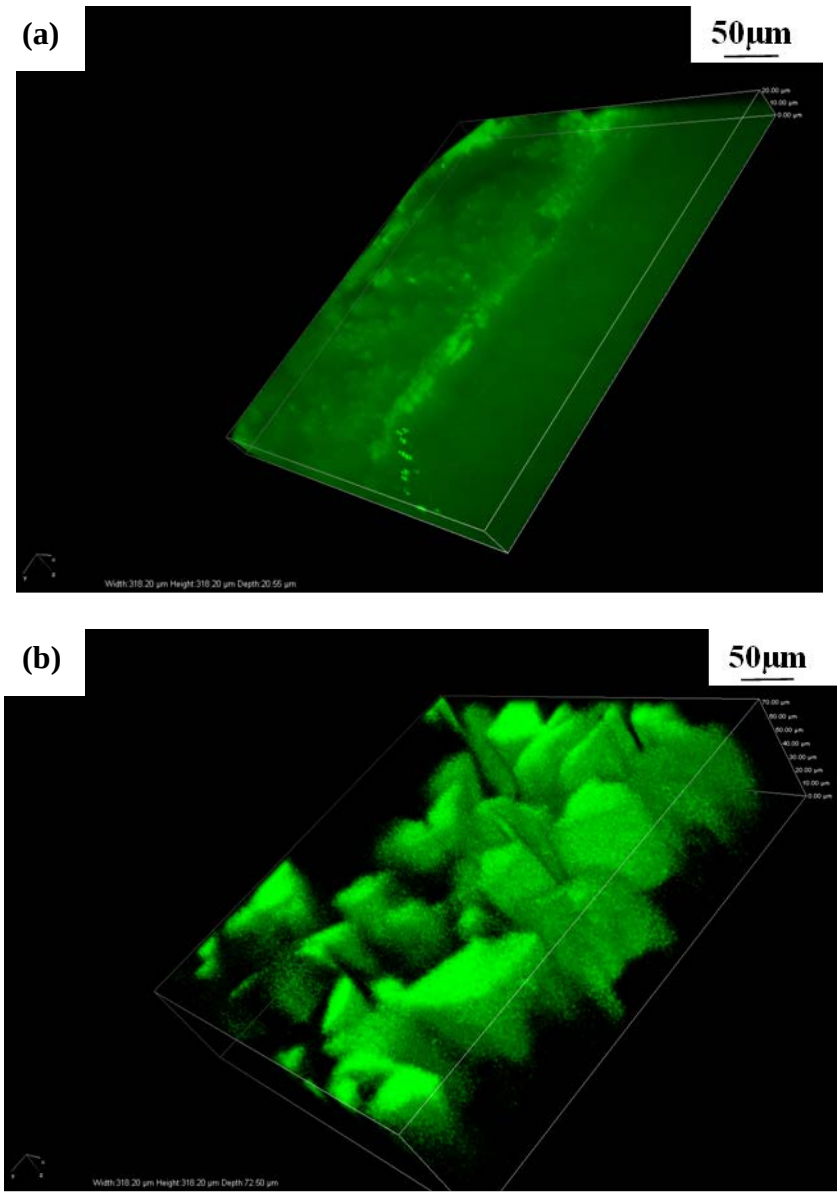

Fig. S1 3D Confocal images of PSA gels synthesized at (a) 25 °C and (b) – 15 °C, respectively. Note that the green area is the gel matrix that was stained with fluorescent FITC dye.

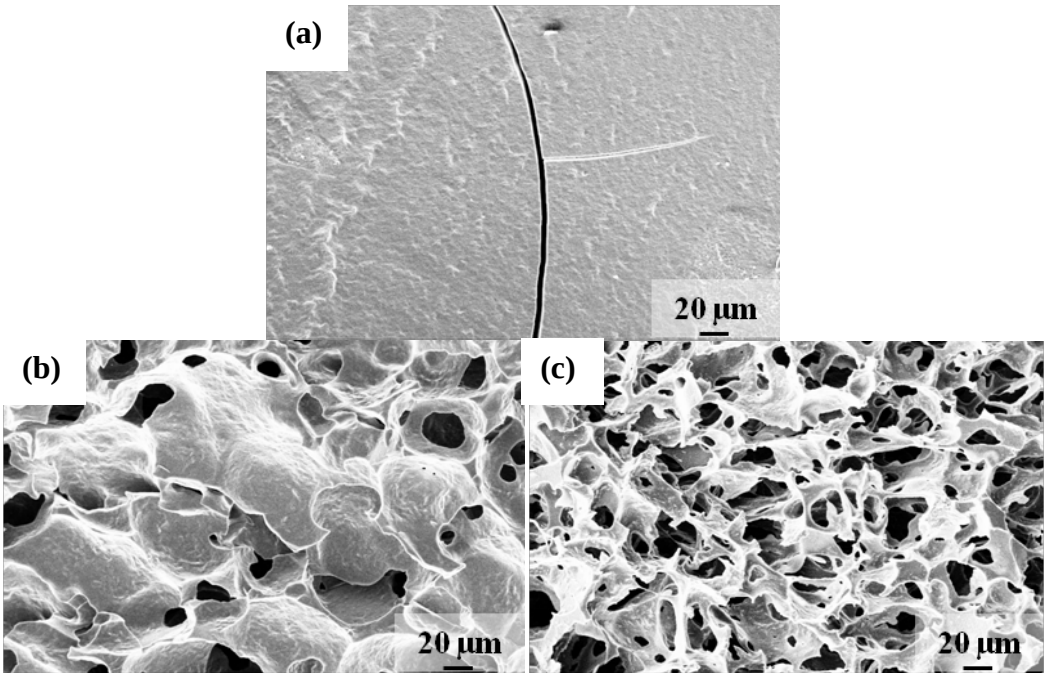

Fig. S2 SEM images of PSA gel cross-sections synthesized at a preparation temperature of (a) – 6 ^{o}C, (b) – 12 ^{o}C, (c) – 15 ^{o}C for an initial monomer concentration of 8%. The APS and TEMED concentrations used were 1.75 mM and 0.125%, respectively. The crosslinker ratio employed was 0.15 mol MBA/mol SA.

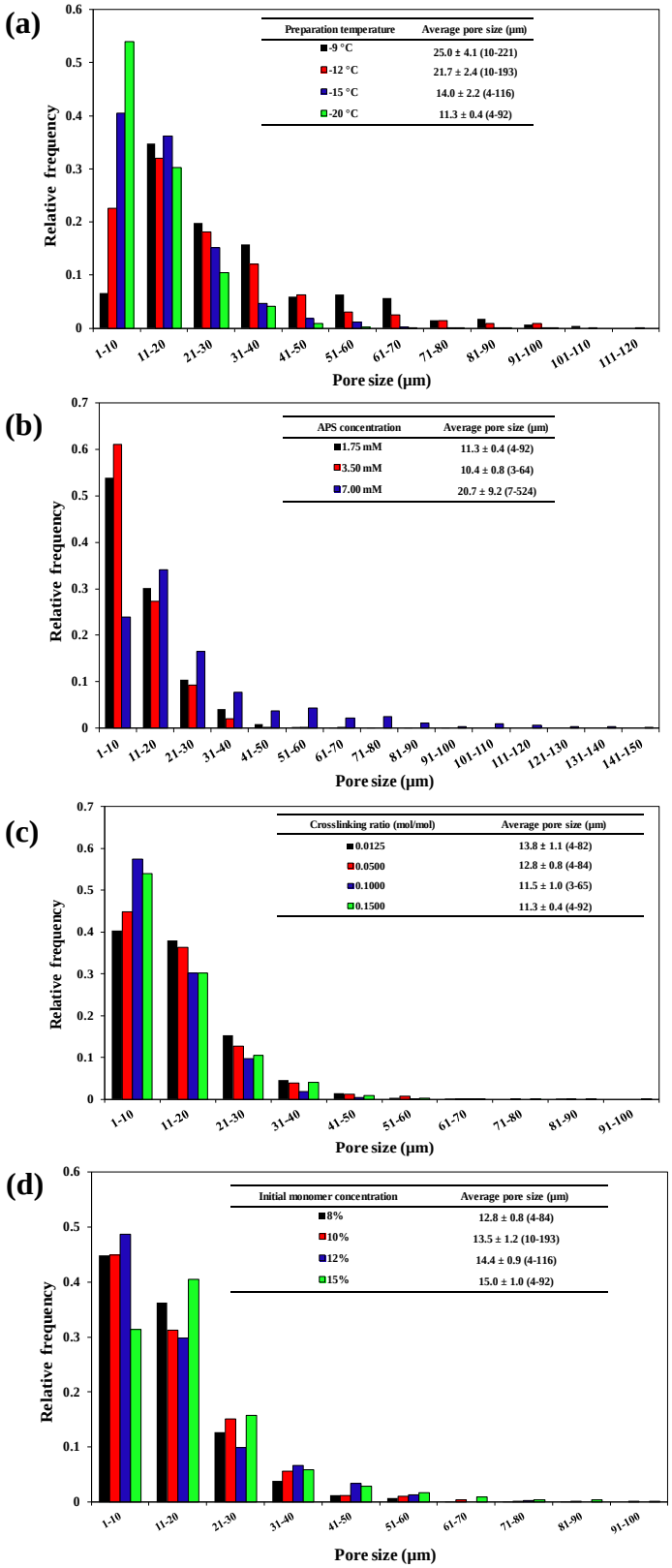

Fig. S3 Effect of (a) preparation temperature, (b) APS concentration, (c) crosslinker ratio, and (d) initial monomer concentration on the pore-size distribution. Note: the figure shows only a limited range of pore sizes. The real range of pore sizes for a given PSA gel sample is shown in parentheses under the "average pore size" column.

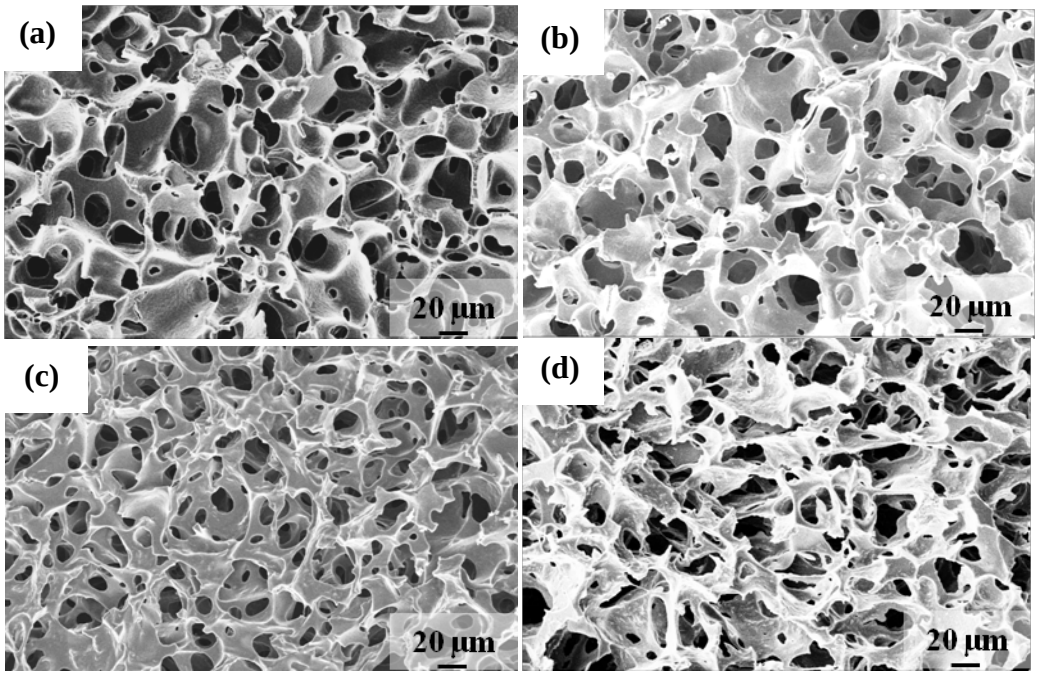

Fig. S4 SEM images of PSA gel cross-sections synthesized at a crosslinking ratio of (a) 0.0125, (b) 0.0500, (c) 0.1000, and (d) 0.1500 mol MBA/mol SA at – 20 ^{o}C for an initial monomer concentration of 8%. The APS and TEMED concentrations were 1.75 mM and 0.125%, respectively.

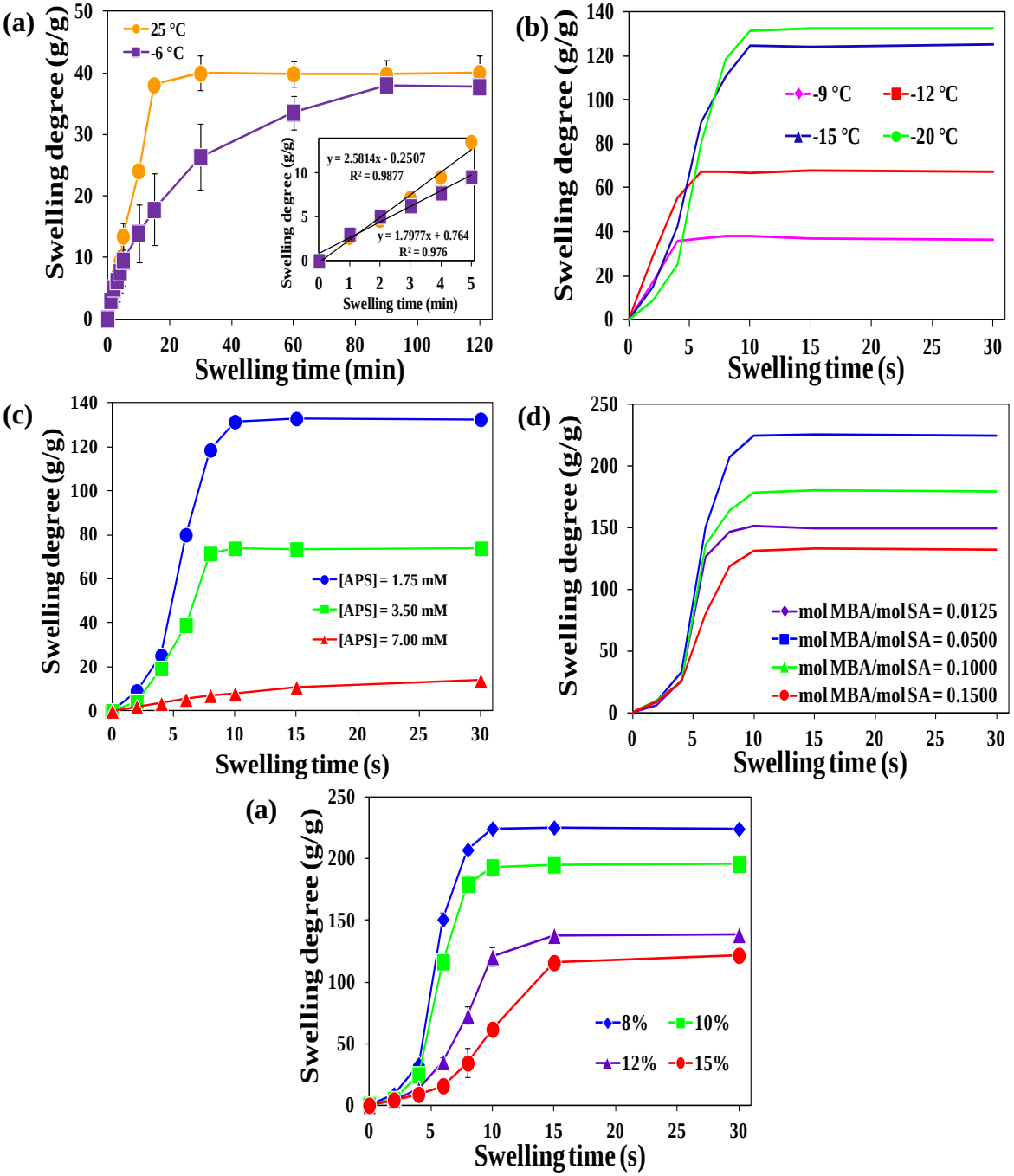

Fig. S5 Dynamic swelling profiles of PSA gels synthesized using different (a and b) preparation temperatures, (c) initiator content, (d) crosslinker ratio, and (e) initial monomer concentration. Note that the timescale used for (a) is different; the inset shows linear fitting of the data obtained during the first 5 min.

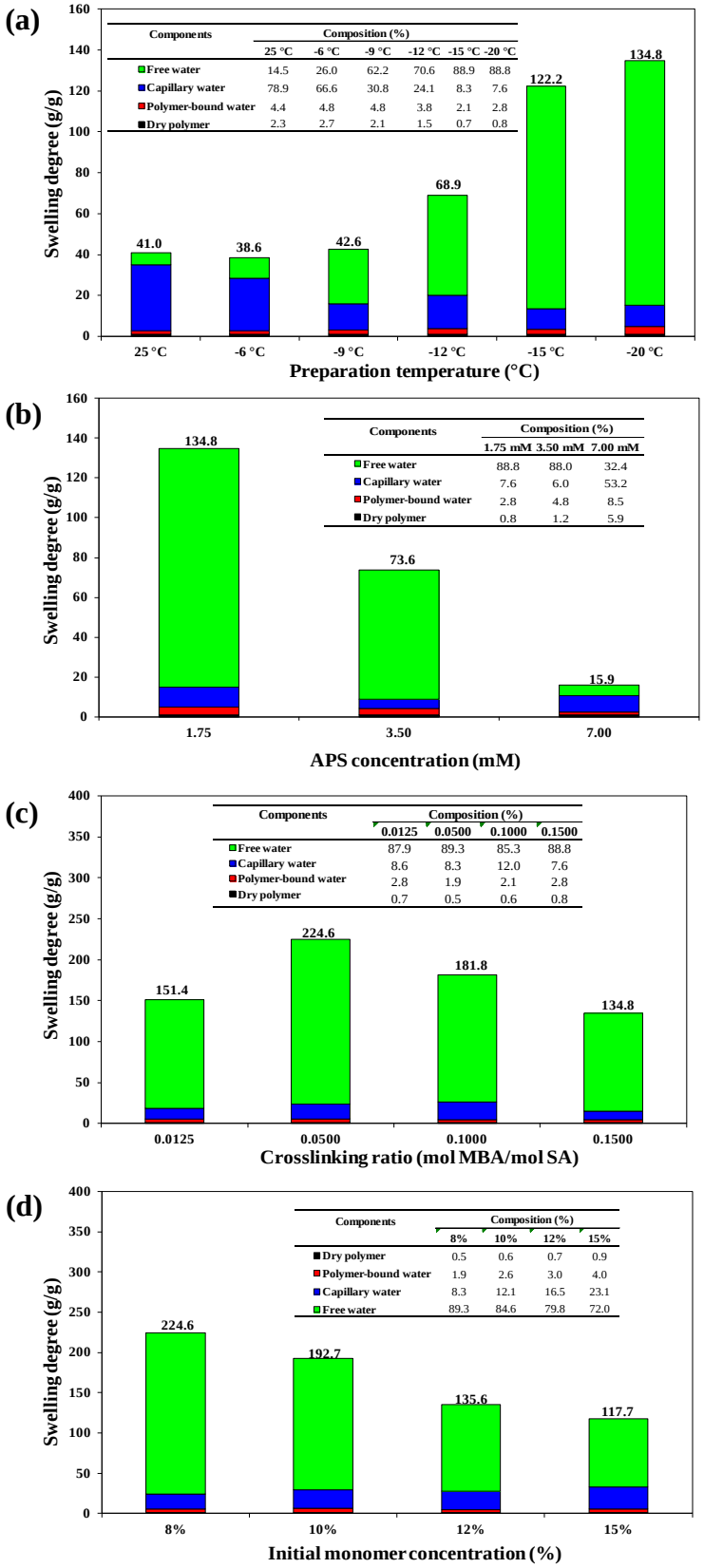

Fig. S6 Effects of preparation temperature (a), APS concentration (b), crosslinker ratio (c), and initial monomer concentration (d) on the swelling degree and distribution of water states in swollen PSA gels.

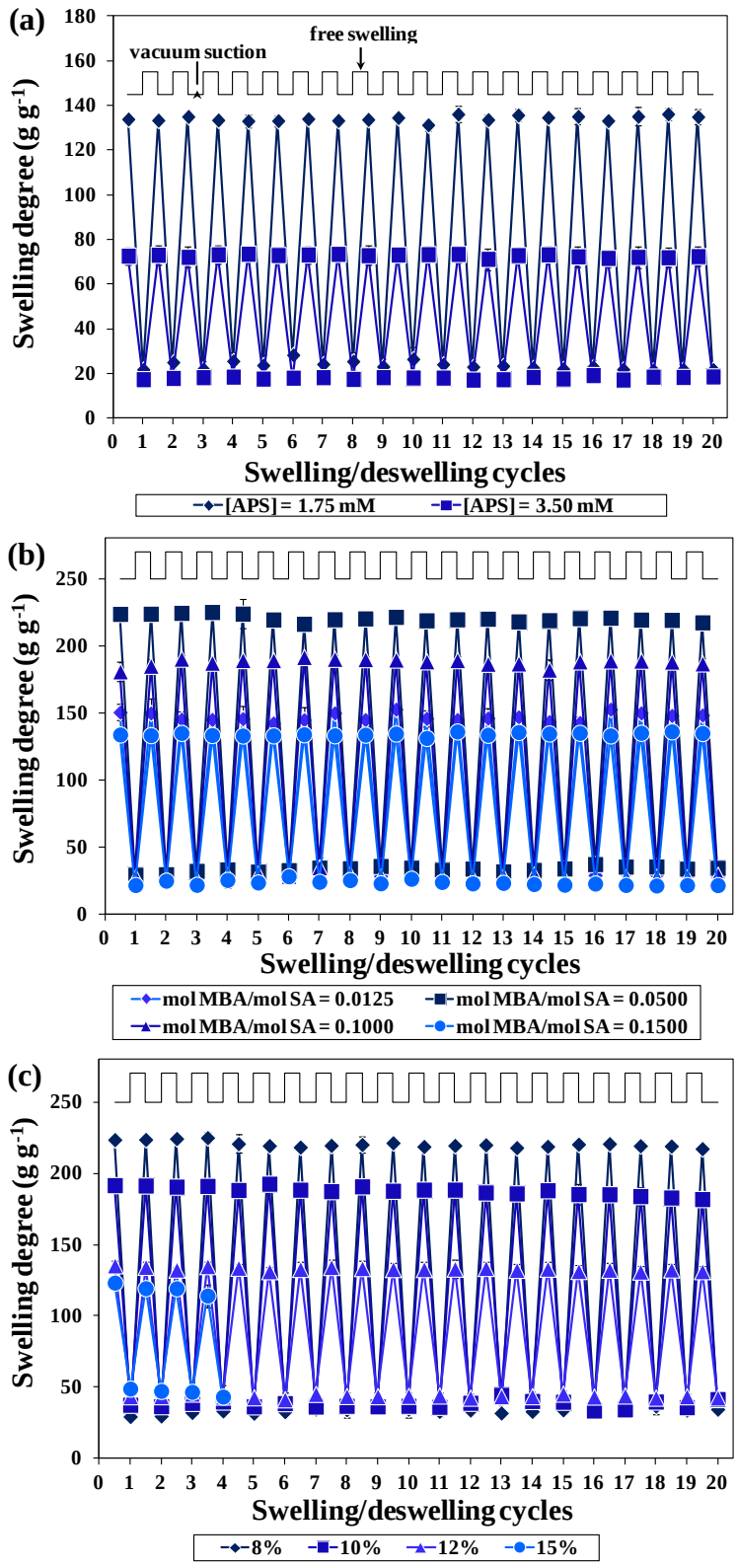

Fig. S7 Effect of (a) initiator content, (b) crosslinker ratio, and (c) initial monomer concentration on the oscillatory swelling-unswelling behavior of PSA cryogels.

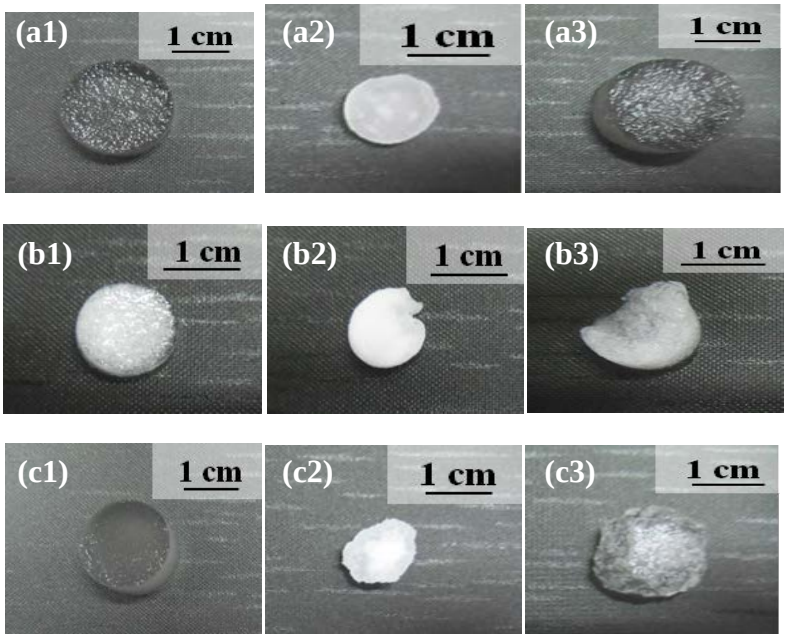

Fig. S8 Digital photographs of PSA cryogels (a) that had the robustness to undergo twenty cycles of swelling and deswelling without any significant loss in network integrity, and (b and c) that broke before the completion of the test. Column (1) shows the swollen PSA cryogels at the start of the test, Column (2) shows the deswollen PSA cryogels at the last cycle, and Column (3) shows the swollen PSA cryogels after the last cycle.

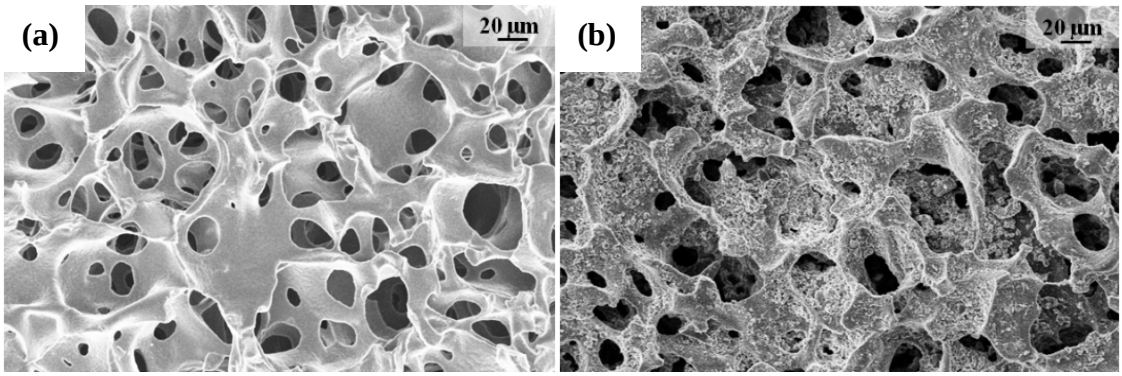

Fig. S9 SEM images of (a) fresh and (b) used PSA cryogels.